

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Stephen J. Todd et al.
Serial No.: 10/787,337
Confirmation No.: 3987
Filed: February 26, 2004
For: METHODS AND APPARATUS FOR INCREASING DATA
STORAGE CAPACITY
Examiner: T. S. Najee-Ullah
Art Unit: 2456

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Dated: December 30, 2009

Signature: 

AMENDMENT IN RESPONSE TO NON-FINAL OFFICE ACTION

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed September 1, 2009, Applicant respectfully requests reconsideration. To further the prosecution of this application, each of the rejections set forth in the Office Action has been carefully considered and is addressed below. The application as presented is believed to be in condition for allowance.

The Office Action indicates that claims 1-67, 69-84, 86-104, and 106-116 are rejected under 35 U.S.C. §103(a) as purportedly being obvious over Heil (6,173,374) in view of Nakayama (2005/0005066)¹, and that claims 68, 85, and 105 are rejected under 35 U.S.C. §103(a) as

¹ In paragraph 5 on page 4, the Office Action indicates that claims 13, 15, 33, 55, 72, 89, and 109 are rejected under 35 U.S.C. §103(a). However, each of these claims is canceled and is no longer pending in the application. Applicant assumes that the indication in the Office Action that each of these claims is rejected is simply an oversight by the Examiner. If this is not correct, clarification as to why these claims are indicated as being rejected is respectfully requested.

purportedly being obvious over Heil, Nakayama, and Iskiyan (5,428,796). For the reasons discussed below, each of these rejections is respectfully traversed.

A. Discussion Of A Content Address

In Applicant's previous response, Applicant argued that neither Heil nor Nakayama fails to disclose the use of a content address that is usable to access a unit of data stored in a content addressable storage environment, and that is based, at least in part, upon at least a portion of the content of the unit of data. Applicant noted that each of independent claims 1, 21, 41, 63, 80, and 97, includes limitations that relate to a unit of data being accessible in the storage environment by a content address that is based, at least in part, upon at least a portion of the content of the unit of data, and that each of claims, and that because neither Heil nor Nakayama discloses such a content address, each of these independent claims patentably distinguishes over the asserted combination of Heil and Nakayama.

In response to this argument, the Office Action contends that Nakayama discloses the use of a content address in ¶0085. While Applicant does not disagree that, in the system of Nakayama, stored data is accessible using an address, the address that is used in Nakayama is not an address that is in any way based on the content of the data that it identifies. Thus, such an address cannot be considered, "a content address that is based, at least in part, upon at least a portion of the content of the unit of data."

1. Overview of Nakayama

As shown in Figure 1, the system of Nakayama comprises a local disk system 10 and remote disk system 40 that are coupled by a Storage Area Network (SAN) (¶0063; ¶0068). The remote disk system 40 is utilized as a data replicating destination apparatus which is used to store a copy of the data that is stored on local disk system 10 (¶0079). A remote copying operation is used to transfer data stored on the local disk system 10 to the remote disk system 40 (¶0079; ¶0082).

Nakayama notes that, when replicating data from a primary storage system to a remote storage system, it is important to ensure that the data was copied correctly and completely, such that if a disaster occurs at the location of the primary storage system that causes a loss of data stored

thereon, the lost data may be recovered using the copy stored on the remote storage location (¶¶0003-0012). Thus, Nakayama is directed to techniques for guaranteeing that, when a remote copying operation is initiated, the data is correctly copied from the primary storage system to the remote storage system.

The Office Action focuses on ¶0085 of Nakayama, which discusses the process by which data is stored on the local disk system 10, and then replicated to the remote disk system 40. This paragraph of Nakayama also discusses how, once the data has been replicated, the system performs a verification that the replication has completed successfully.

In particular, at ¶0085, Nakayama discloses that host computer 1 sends a request to local disk system 10 to write data (lines 1-4). Local disk writing unit 101 in local disk system 10 receives the data to be written and writes the data to cache memory 26 in local disk system 10 (lines 3-4). Disk control unit 24 in local disk system 10 then moves the data from the cache to a disk in disk device group 30 (lines 4-7).

When the data writing operation to the local disk system is completed, remote disk writing unit 102 in local disk system 10 transmits the data received from host computer 1 via SAN 3 to remote disk system 40, and this data is stored in cache memory 56 in remote disk system 40 (lines 7-11). Disk control unit 54 then moves this data from the cache memory to a disk in disk device group 60 (lines 11-14).

Once the data writing operation in remote disk system 40 is complete, remote disk reading unit 103 in local disk system 10 reads, via SAN 3, the data that was just written by the remote disk from remote disk system 40 (lines 14-19). Write judging unit 104 in local disk system 10 then compares the data that was written to remote disk system 40 by remote disk writing unit 102 with the data that was read from remote disk system 103 to ensure that they match (lines 21-26). If they are not identical, write judging unit determines that an error has occurred (lines 31-35).

2. Nakayama Does Not Disclose The Use Of A Content Address

As discussed above, Applicant agrees that, in the system of Nakayama, data is accessible using an address. However, the address that is used to access data is not based, at least in part, upon

at least a portion of the content of the unit of data. As explained ¶0072 of Nakayama, requests to access data specify a logical address for the data. The storage system then converts this logical address to a physical disk address where, in the case of a write request, the data may be stored or, from where, in the case of a read request, the data may be read. Nakayama does not disclose or suggest that either the logical address or the physical address for data is based upon the content of the data.

On page 3, the Office Action quotes the portion of paragraph ¶0085 of Nakayama that states:

After an address of the data written in the cache memory 26 is converted by the disk control unit 24, the address-converted data is stored in a predetermined area of the disk device group 30. When the data writing operation to the local disk is completed, the remote disk writing unit 102 transmits data received from the host computer 1 via the SAN 3 to the remote disk system 40 so as to store this transmitted data into the cache memory 56. After the address of the stored data in the cache memory 56 of the remote disk system 40 is converted by the disk control unit 54, the address-converted data is stored in the remote disk.

The Office Action asserts that this portion of Nakayama somehow discloses a content address that is based, at least in part, upon at least a portion of the content of a unit of data. Applicant respectfully disagrees. Applicant respectfully disagrees.

As explained above, the above-quoted portion of Nakayama merely discloses that when a host computer sends a write request to store data on local disk system 10, the data is stored in the cache memory 26 of the local disk system 10. The logical address that the host computer used to specify the location at which the data is to be stored is then converted to a physical disk address, and the data is moved from cache memory 26 to this physical disk address in disk device group 30.

This portion of Nakayama further explains that, once the data is stored on local disk system 10, it is replicated to remote disk system 40 via SAN 3. The data is initially stored in cache memory 56 of remote disk system 40, and then is moved to disk.

While Applicant agrees that the write requests to store data on remote disk system 10 and remote disk system 40 specify addresses at which the data is to be stored, Nakayama does not disclose or suggest that these addresses are in any way based on the content of the data to be stored.

3. Clarification On Response To Arguments

On page 3, in the Response to Arguments section, the Office Action quotes the portion of paragraph ¶0085 of Nakayama that states:

As a result, the write judging unit 104 compares the data written into the local disk with the data read from the remote disk just after the data has been transferred to the remote disk, and it judges whether or not both data are identical to each other.

With respect to the above-quoted portion of Nakayama the Office Action states, “Examiner equates this aspect of Nakayama to the content addressable hash function mentioned in the Applicant’s specification and definition of content addressable storage.” Applicant would appreciate clarification on this point.

As discussed above, the above-quoted portion of Nakayama merely indicates that after the local disk writing unit has replicated some data to the remote disk writing unit, it immediately sends a read request for this same data and compares the data that it requested be replicated to the data that it read to determine whether any errors occurred in the replication process. It does not have anything to do with the type of address that is used in accessing the data. Thus, Applicant would appreciate clarification as to how the Examiner is interpreting this portion of Nakayama to be relevant to the use of a content address.

B. Independent Claims 1, 21, 41, 63, 80, and 97

Each of independent claims 1, 21, 41, 63, 80, and 97 includes limitations that relate to the unit of data being accessible in the storage environment by a content address that is based, at least in part, upon at least a portion of the content of the unit of data.

As should be clear from the discussion above, neither Heil and Nakayama discloses or suggests the use of content addresses. Thus, each of these independent claims patentably distinguishes over the asserted combination Heil and Nakayama, and it is respectfully requested that the rejection of each of these claims be withdrawn.

C. General Comments On Dependent Claims

Each of the dependent claims depends directly or indirectly from one of the independent claims. For reasons described in detail above, each of the independent claims patentably distinguishes over the references and each of these dependent claims distinguishes over the references at least based on its dependency.

Accordingly, for at least the foregoing reasons, it is respectfully requested that the rejections of each of the dependent claims be withdrawn.

Because each of the dependent claims depends from a base claim that is believed to be in condition for allowance, Applicant believes that it is unnecessary at this time to argue the allowability of each of the dependent claims individually. However, Applicant does not necessarily concur with the interpretation of the dependent claims as set forth in the Office Action, nor does Applicant concur that the basis for the rejection of any of the dependent claims is proper.

CONCLUSION

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825 under Docket No. E0295.70199US00 from which the undersigned is authorized to draw.

Dated: December 30, 2009

Respectfully submitted,

By 

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